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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/767,275	01/29/2004	Ming Fu Li	IME03-009	4286

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EXAMINER	
NADAV, ORI	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 01/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/767,275	LI ET AL.	
	Examiner	Art Unit	
	Ori Nadav	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 October 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-10* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102/3

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3 and 10 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Krivokapic (6,291,832). Krivokapic teaches in figure 5 and related text a resonant tunneling diode (RTD) using low band offset dielectric material as double barrier layers and having a vertical layer configuration comprising:

a substrate having a substantially planar horizontal surface;

a horizontally disposed configuration of vertical layers formed on said substrate, said layers being perpendicular to said horizontal surface, said configuration further comprising:

a quantum well layer 204 formed of a semiconductor material, said layer being vertical, having parallel planar vertical sides and being formed to a first thickness;

a tunneling barrier layer 208 formed on each side of said quantum well layer, each said barrier layer being formed, to a second thickness, of a dielectric material characterized by a low band offset relative to the conduction band edge of said semiconductor material; and

an adjacent conducting contact layer 206 being formed on each said tunneling barrier layer,

wherein said quantum well layer is oriented so that its vertical sides are any preferred crystallographic plane, and

wherein said substrate is a SOI, GOI or SiGe-on oxide substrate and wherein an isolating layer is interposed between said substrate and said horizontally disposed configuration.

Krivokapic does not state that the quantum well layer formed by photolithographic patterning and etching, and the tunneling barrier layer formed by a process of CVD, ALD or sputtering.

However, the claimed limitations of a quantum well layer formed by photolithographic patterning and etching, and a tunneling barrier layer formed by a process of CVD, ALD or sputtering are process limitations which would not carry patentable weight in this claim drawn to a structure, because distinct structure is not necessarily produced. Note that a "product by process" claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173

USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); and In re Marosi et al., 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. Note that the applicant has the burden of proof in such cases, as the above case law makes clear.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> **(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.**

Claims 2 and 4-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Krivokapic.

Regarding claim 2, Krivokapic teach substantially the entire claimed structure, as applied to claim 1 above, except a quantum well semiconductor material being monocrystalline Si, Ge or SiGe.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a quantum well semiconductor material being

monocrystalline Si, Ge or SiGe in Krivokapic's device in order to improve the characteristics of the device, since the advantages of a single crystal silicon are well known in the art, of which official notice is taken.

Regarding claim 4, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a low band offset dielectric material being a high-k dielectric material Si3N4, Hfo2, ZrO2, Y2O3, Pr2O3, TiO2, Al2O3, or Ta2O5, or their alloys or laminates in Krivokapic's device in order to improve the characteristics of the device. Note that substitution of materials is not patentable even when the substitution is new and useful. Safetran Systems Corp. v. Federal Sign & Signal Corp. (DC NIII, 1981) 215 USPQ 979.

Regarding claims 5, 7 and 8, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the dielectric material to a second thickness of between approximately 0.5 nm and 5.0 nm, to form the silicon quantum well layer to a first thickness between approximately 2 nm and 25 nm, and to dope the silicon quantum well layer with either n-type or p-type doping to a dopant concentration between approximately El6 and E19 cm(-3) in Krivokapic's device in order to improve the characteristics of the device, subject to routine experimentation and optimization. When the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller , 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955). Applicant can rebut a prima facie case of

obviousness based on overlapping ranges by showing unexpected results or the criticality of the claimed range. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims . . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." In re Woodruff , 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). See MPEP § 716.02 - § 716.02(g) for a discussion of criticality and unexpected results.

Regarding claims 6 and 7, prior art teaches a quantum well layer being in a crystallographic planes of 100, 110 or 111 crystallographic planes, wherein the quantum well layer is characterized by at least one electron bound state and associated bound state energy.

Regarding claim 9, it is conventional to reverse the polarity of the device. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to a conducting layer of n+ doped polysilicon, as claimed.

Response to Arguments

Applicant argues that Krivokapic's device is different from the claimed structure, because in the language of the present claimed invention, the claimed barrier layers are

the low band offset dielectric layers and providing a potential barrier to injected electrons, wherein biasing the barrier layers controls the flow of conduction electrons to the quantum well.

Claim 1 recites a tunneling barrier layer being formed of a dielectric material characterized by a low band offset relative to the conduction band edge of said semiconductor material. Krivokapic teaches a tunneling barrier layer being formed of a dielectric material characterized by a low band offset relative to the conduction band edge of said semiconductor material. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant argues that in Krivokapic's device the only structures abutting his vertical layer 208 in his figure 5 are the doped regions 206 and 204 within the body of the SOI substrate.

Figure 5 of Krivokapic clearly depicts undoped regions 208 abutting the vertical layer 208.

Applicant argues that although an SOI substrate is used by both Krivokapic and the present inventors, the SOI substrate is used differently by Krivokapic and by the present applicants.

Claim 10 recites an SOI substrate. Krivokapic teaches an SOI substrate. Therefore, Krivokapic's structure is identical to the claimed structure, even if the SOI substrate is used differently by Krivokapic and by the present applicants.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ori Nadav whose telephone number is 571-272-1660. The examiner can normally be reached between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

O.N.
12/30/05

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